

Patel et al.

## METHOD AND COMPOSITION FOR THE GRADUAL PERMANENT COLORING OF HAIR

### RELATED APPLICATIONS

The present application is a Continuation in Part of U.S. Serial No. 09/811,920, filed March 19, 2001.

### BACKGROUND OF THE INVENTION

The present invention relates to a method for the permanent coloring of hair with longer lasting conditioning and with minimized hair damage.

Most hair coloring products fall under three major groupings:

1. Temporary hair color.
2. Semi permanent hair color.
3. Permanent hair color.

Temporary hair color is a leave on product that causes minimal damage to the hair. However, temporary hair color causes stains, and leaches out under rain or with perspiration. Temporary hair color washes out with the next shampoo. Temporary hair color also does not give any control to the consumer over the amount of color deposited or the permanency of the color supplied. Temporary hair color does not result in a wide variety of colors and it has only a limited appeal.

Semi-permanent hair color comes as a rinse, and it causes minimal damage to the hair. However, semi-permanent hair color washes out to some degree with each shampoo and washes out completely within about 4 to 6 shampoos. Semi permanent hair color does not give the consumer any control regarding the amount of color deposited or the permanency of the color. Semi-permanent hair color has limited popularity with consumers.

Permanent hair color generally comes in two parts: a dye solution and a developer solution. Because of the damaging nature of conventional permanent hair coloring treatments, most home coloring products come with a post treatment conditioner. In a permanent hair coloring treatment, the dye solution and the developer solution are mixed and then applied to the hair, which is then left for about 25 to about 35 minutes. The hair is then rinsed with water, treated with a post treatment conditioner, and then rinsed again with water.

The application of the dye solution and the developer solution affords permanent hair coloring. However, this method does not provide any conditioning benefit. The conditioning benefit comes through application of the post treatment conditioner, and it is only temporary. The conditioning benefit is lost with the next shampoo. Moreover, with permanent hair coloring treatments, shampooing the hair is usually not recommended after said treatments. Thus, hair is left feeling dirty, and can stain towels and pillows.

Permanent hair coloring products need to be applied every four to six weeks, since hair grows out of the scalp at the rate of approximately one half inch per month. Each coloring application causes damage to the hair, and that damage is cumulative. Hair color touch ups after the initial treatment would also damage hair more.

It would be desirable to develop a method for permanently coloring hair that conditions hair, gives hair a soft clean feel, and minimizes the damage caused to hair by the coloring process. The present invention provides such a method.

Conventional permanent hair coloring products cannot be used safely in the shower. It is an object of this invention to develop a method for permanently coloring hair, which can be carried out safely in the shower. It is also an object of the invention to provide a method for permanently coloring hair wherein the user has control of the amount of permanent or durable color deposited without causing hair damage. It is also an object of the invention to provide a method for permanently coloring hair wherein the user has control over the amount lifting/lightening without causing hair damage. It is also an object of the invention to provide a method for permanently coloring hair wherein the user can employ the product as his or her daily hair care product to avoid new outgrowth of uncolored hair. It is also an object of the invention to provide a method for permanently coloring hair wherein said method involves less mess and difficulty than conventional permanent hair coloring methods. It is also an object of the invention to provide a method for permanently coloring hair wherein said method brings about gradual permanent hair color changes with each application. Since gradual hair color changes are to occur, such a method would be virtually mistake free because the consumer could stop or alter the coloring method if he or she did not like the course the hair coloring was taking. It is also an object of the invention to provide a method for permanently coloring hair wherein the amount of hair coloring composition employed can be varied from application to application in order to adjust the hair coloring results.

These and other aspects of this invention will become evident by a detailed description of the invention given below.

Patents related to the field of this invention are as follows:

U.S. Patent No. 4,104,021 which discloses a process in which human hair is dyed in successive treatments at selected intervals with oxidation colors (aromatic primary amines and amino phenols) admixed in each treatment with an oxidizing agent ( $H_2O_2$  or a derivative thereof) -- the quantity of oxidation colorant applied in each treatment being substantially the same and the quantity of oxidizing agent being

increased from the first to the last treatment to effect a gradual increase in depth of shade – the mixture being allowed to remain on the hair for substantially the same time in each treatment, followed by removal by rinsing.

5 U.S. Patent 4,529,404 discloses an autoxidizable hair dye preparation capable of coloring or darkening hair when applied thereto and exposed to the atmosphere comprising a mixture of (I) at least one p-phenylene diamine compound, or An acid addition salt thereof, and (II) at least one 1,2,4- benzenetriol compound, each compound optionally containing nucleary substituted C.sub.1-4 alkyl, alkoxy,  
10 hydroxyalkyl or halogen. The preparation is preferably applied and exposed to the atmosphere repeatedly until the desired degree of darkening or color build-up is attained.

The preparations of this invention may also contain known additives or assistants  
15 such as hair grooming agents, for example quaternized vinyl pyrrolidone copolymers, carboxyvinyl polymers and the like, plasticizers, conditioners, thickeners, slip and wetting agents such as polyoxyethylenated fatty (e.g. lauryl) alcohols, stearyldimethylammonium chloride, silicone copolymer, foam boosters, preservatives, perfumes and the like.

U.S. Patent 5,968,486 describes a shampoo composition for lightening and highlighting hair which comprises

- (i) a peroxygen compound; and
- (ii) an anionic sulfonate;

said composition having a pH less than 5. There is also described an invention directed to a method for lightening and highlighting hair which comprises shampooing the hair with a lightening and highlighting effective amount of a composition of the invention.

Co-pending and commonly assigned U.S patent application Serial No. 09/558,235, filed April 24, 2000 discloses a hair conditioning composition for conditioning, lightening, and highlighting hair, which comprises

- i) peroxygen compound, and
  - ii) a conditioning agent,
- said composition having a pH of 5 or less.

## SUMMARY OF THE INVENTION

The invention relates to a method for achieving permanent desired hair color change through the daily or frequent use of hair care compositions. The hair care compositions of the invention comprise a mixture of two compositions, part A and part B as described just below:

Part A: oxidation hair dyes in a conditioner or shampoo base at alkaline pH

Part B: an oxidative hair dye such as hydrogen peroxide in a conditioner or shampoo base at acidic pH.

## DETAILED DESCRIPTION OF THE INVENTION

Unless otherwise indicated, all percentages used herein are percentages by weight of active material based on the weight of the respective composition.

The present invention relates to specific compositions which are a mixture of part A and part B as described just below:

Part A: oxidation hair dyes in a conditioner or shampoo base at alkaline pH

Part B: an oxidative compound such as hydrogen peroxide in a conditioner or shampoo base at acidic pH

In the case of compositions in a shampoo base,

Part A comprises from

- a) about 0.1 to about 99.9% of a shampoo base, wherein the conditioning agent within said shampoo base comprises from about 0.5 to about 10% of the total composition % of a conditioner;
- b) about 0.1 to about 5% of oxidation dyestuffs;
- c) about 0.1 to about 5% of a coupling compound.

More preferably, in the case of compositions in a shampoo base, part A can comprise from

- a) about 1 to about 95 % of a shampoo agent;
- b) about 0.1 to about 0.5 % of an oxidation hair dye;
- c) about 0.1 to about 1% coupling compound.

More preferably for compositions in a shampoo base,

Part B comprises from:

- a) about 1 to about 95 % of a shampoo agent; and
- b) about 1 to about 5 % of an oxidizing compound.

For compositions in a shampoo base  
part A comprises:

- a) about 0.1 to about 99.9% of a shampoo base, wherein the detergent foaming agent within said shampoo base comprises from about 0.5 to about 50% of the total composition of a shampoo agent;
- b) about 0.1 to about 5% of oxidative hair dyes;
- c) about 0.1 to about 5% of a coupling compound.

More preferably, in the case of compositions in a shampoo base,  
part A can comprise from

- a) about 2 to about 50 % of a detergent foaming agent;
- b) about 0.1 to about 0.5 % of dye;
- c) about 0.1 to about 1% coupling compound.

For compositions in a shampoo base part B comprises:

- a) about 0.5 to about 50% of a detergent foaming agent; and
- b) about 1 to about 5 % of an oxidizing compound.

More preferably, in the case of compositions in a shampoo base, part A can  
comprise from

- a) about 1 to about 15% of a detergent foaming agent; and
- b) about 1 to about 5 % of an oxidization hair dye.

For compositions in a shampoo base part B comprises:

- a) about 2 to about 50% of a detergent foaming agent; and
- b) about 2 to about 5 % of an oxidizing compound.

Specific conditioner bases of the invention, part A, can comprise about 0.5 to  
about 0.5 to about 5% of a quaternary nitrogen-containing conditioning agent having  
two long aliphatic chains each of which contains about 12 to about 18 carbons and two

short chain alkyl groups having one or two carbon atoms each bonded to quaternary nitrogen, about 1 to about 10% of a higher molecular weight fatty alcohols such as cetyl alcohol and stearyl alcohol; and about 1% to about 4% of a volatile silicone such as dimethicone and the dyestuff.

5

Specific conditioner bases of the invention, part B can comprise about 0.5 to about 0.5 to about 5% of a quaternary nitrogen-containing conditioning agent having two long aliphatic chains each of which contains about 12 to about 18 carbons and two short chain alkyl groups having one or two carbon atoms each bonded to quaternary nitrogen, about 1 to about 10% of a higher molecular weight fatty alcohols such as cetyl alcohol and stearyl alcohol; and about 1% to about 4% of a volatile silicone such as dimethicone.

10

15

Shampoo compositions of the invention comprise from about 0.5 to about 50% of an anionic surfactant or an amphoteric surfactant or mixtures thereof.

Conditioning compositions of the present invention comprise a mixture of part A and part B wherein:

20

Part A comprises:

- a) about 0.1% to about 99.9% of a conditioning base, which comprises about 0.05% to about 10% of a conditioning agent based upon the total composition;
- b) about 0.1% to about 1% of a dye; and
- c) a volatile silicone;

25

Part B comprises:

- a) about 1 to about 5% of a conditioning base;
- b) about 1 to about 5% of an oxidative compound.

30



A conditioning composition of the invention is a composition as described just above, which further comprises in part A, part B, or part A and part B, a thickener which is a high molecular weight fatty alcohol wherein said high molecular weight fatty alcohol is selected from the group consisting of cetyl alcohol and stearyl alcohol.

What follows is a description of the ingredients that can be included in the compositions of the present invention.

## HAIR DYES AND HAIR COLORING AGENTS

The part A compositions of the present invention include as an essential feature one or more oxidative hair dyes. These oxidative hair coloring dyes are present in compositions of the present invention which have a conditioner base, and compositions of the present invention which have a shampoo base. Such oxidative hair-coloring agents are used in combination with the oxidizing systems of the present invention to formulate permanent hair dye compositions.

Permanent hair dye compositions as defined herein are compositions, which once applied to the hair, are substantially resistant to washout.

## OXIDATIVE HAIR DYES

The dye forming intermediates used in oxidative dyes are essentially aromatic diamines, aminophenols and their derivatives. These dye forming intermediates can be classified as; primary and secondary intermediates, couplers and modifiers, and nitro dyes. Primary intermediates are chemical compounds, which by themselves will form a dye upon oxidation. The secondary intermediates, also known as color modifiers or couplers and are used with other intermediates for specific color effects or to stabilize

the color. Nitro dyes are unique in that they are direct dyes, which do not require oxidation to dye the hair.

The oxidation dye intermediates, which are suitable for use in the compositions and processes herein include aromatic diamines, polyhydric phenols, aminophenols and derivatives of these aromatic compounds (e.g., N-substituted derivatives of the amines, and ethers of the phenols). Primary oxidation dye intermediates are generally colorless molecules prior to oxidation. The oxidation dye color is generated when the primary intermediate is 'activated' and subsequently enjoined with a secondary intermediate (coupling agent), which is also generally colorless, to form a colored, conjugated molecule. In general terms, oxidation hair dye precursors or intermediates include those monomeric materials which, on oxidation, form oligomers or polymers having extended conjugated systems of electrons in their molecular structure. Because of the new electronic structure, the resultant oligomers and polymers exhibit a shift in their electronic spectra to the visible range and appear colored. For example, oxidation dye precursors capable of forming colored polymers include materials such as aniline, which has a single functional group and which, on oxidation, forms a series of conjugated imines and quinoid dimers, trimers, etc. ranging in color from green to black. Compounds such as p-phenylenediamine, which has two functional groups, are capable of oxidative polymerization to yield higher molecular weight colored materials having extended conjugated electron systems. Color modifiers (couplers), such as those detailed hereinafter, are preferably used in conjunction with the oxidation dye precursors herein and are thought to interpose themselves in the colored polymers during their formation and to cause shifts in the electronic spectra thereof, thereby resulting in slight color changes. A representative list of oxidation dye precursors suitable for use herein is found in Sagarin, "Cosmetic Science and Technology", Interscience, Special Edition, Volume 2, pages 308 to 310.

It is to be understood that the oxidizing aids of the present invention are suitable for use (in combination with a source of peroxide as detailed herein) with all manner of oxidation dye precursors and color modifiers and that the precursors detailed below are

only by way of example and are not intended to limit the compositions and processes herein.

The typical aromatic diamines, polyhydric phenols, aminophenols, and derivatives thereof, described above as primary dye precursors can also have additional substituents on the aromatic ring, e.g. halogen, aldehyde, carboxylic additional substituents on the amino nitrogen and on the phenolic oxygen, e.g. substituted and unsubstituted alkyl and aryl groups.

The hair coloring compositions of the present invention may, in addition to the essential oxidative hair-coloring agents, optionally include non-oxidative and other dye materials. Optional non-oxidative and other dyes suitable for use in the hair coloring compositions and processes according to the present invention include semi-permanent, temporary and other dyes. Non-oxidative dyes as defined herein include the so-called 'direct action dyes', metallic dyes, metal chelate dyes, fiber reactive dyes and other synthetic and natural Chemical and Physical Behaviour of Human Hair' 3rd Edn. by Clarence Robbins (pp 250-259); 'The Chemistry and Manufacture of Cosmetics'. Volume IV. 2nd Edn. Maisson G. De dyes. Various types of non-oxidative dyes are detailed in: 'Navarre at chapter 45 by G. S. Kass (pp 841-920); 'cosmetics: Science and Technology' 2nd Edn, Vol II Balsam Sagarin, Chapter 23 by F. E. Wall (pp 279-343); 'The Science of Hair Care' edited by C. Zviak, Chapter 7 (pp 235-261) and 'Hair Dyes', J. C. Johnson, Noyes Data Corp., Park Ridge, U. S.A. (1973), (pp 3-91 and 113-139).

Specific hair dyes which may be included in the compositions of the invention include m-aminophenol, p-phenylene diamine, p-toluenediamine; p-phenylenediamine; 2-chloro-p-phenylenediamine; N-phenyl-p-phenylenediamine; N-2-methoxyethyl-p-phenylenediamine; N,N-bis-(hydroxyethyl)-p-phenylenediamine; 2-hydroxymethyl-p-phenylenediamine; 2-hydroxyethyl-p-phenylenediamine; 4, 4'-diaminodiphenylamine; 2,6-dimethyl-p-phenylenediamine; 2-isopropyl-p-phenylenediamine; N-(2-hydroxypropyl)-p-phenylenediamine; 2-propyl-p-phenylenediamine; 1,3-N, N-bis-(2-

hydroxyethyl)-N, N-bis (4-aminophenyl)- 2-propanol; 2-methyl-4-dimethylaminoaniline; p-aminophenol; p- methylaminophenol; 3-methyl-p-aminophenol; 2-hydroxymethyl-p-aminophenol; 2-methyl-p-aminophenol; 2-(2-hydroxyethylaminomethyl)-p-aminophenol; 2-methoxymethyl-p-aminophenol; and 5-aminosalicylic acid; catechol; pyrogallol; o-aminophenol; 2, 4-diaminophenol; 2,4,5-trihydroxytoluene; 1,2,4-trihydroxybenzene; 2-ethylamino-p-cresol; 2,3-dihydroxynaphthalene; 5-methyl-o-aminophenol; 6-methyl-o-aminophenol; and 2-amino-5-acetaminophenol; 2-methyl-1- naphthol; 1-acetoxy-2-methylnaphthalene; 1,7-dihydroxynaphthalene; resorcinol; 4-chlororesorcinol; 1-naphthol; 1,5-dihydroxynaphthalene; 2,7-dihydroxynaphthalene; 2-methylresorcinol; 1-hydroxy-6-aminonaphthalene- 3-sulfonic acid; thymol (2-isopropyl-5-methylphenol); 1,5-dihydroxy-1,2, 3,4-tetrahydronaphthalene; 2-chlororesorcinol; 2,3-dihydroxy-1,4-naphthoquinone; and 1-naphthol-4-sulfonic acid; m-phenylenediamine; 2-(2,4-diaminophenoxy)ethanol; N,N-bis(hydroxyethyl)-m-phenylenediamine; 2,6-diaminotoluene; N,N-bis(hydroxyethyl)-2,4-diaminophenetole; bis(2,4- diaminophenoxy)-1,3-propane; 1-hydroxyethyl-2,4-diaminobenzene; 2-amino- 4-hydroxyethylaminoanisole; aminoethoxy-2,4-diaminobenzene; 2,4-diaminophenoxyacetic acid; 4,6-bis(hydroxyethoxy)-m-phenylenediamine; 2,4-diamino-5-methylphenetole; 2,4-diamino-5-hydroxyethoxytoluene; 2,4- dimethoxy 1,3-diaminobenzene; and 2,6-bis(hydroxyethylamino) toluene; m-aminophenol; 2-hydroxy-4- carbamoylmethylaminotoluene; m-carbamoylmethylaminophenol; 6-hydroxybenzomorpholine; 2-hydroxy-4-aminotoluene; 2-hydroxy-4-hydroxyethylaminotoluene; 4,6-dichloro-m-aminophenol; 2-methyl-m- aminophenol; 2-chloro-6-methyl-m-aminophenol; 2-hydroxyethoxy-5- aminophenol; 2-chloro-5-trifluoroethylaminophenol; 4-chloro-6-methyl-m- aminophenol; N-cyclopentyl-3-aminophenol; N-hydroxyethyl-4-methoxy-2-methyl-m-aminophenol and 5-amino-4-methoxy-2-methylpheno; 2-dimethylamino-5-aminopyridine; 2,4,5,6-tetra-aminopyrimidine; 4,5-diamino-1-methylpyrazole; 1-phenyl-3- methyl-5-pyrazolone; 6-methoxy-8-aminoquinoline; 2,6-dihydroxy-4-methylpyridine; 5-hydroxy-1,4-benzodioxane; 3,4-methylenedioxyphenol; 4-hydroxyethylamino-1,2-methylenedioxybenzene; 2,6-dihydroxy-3,4- dimethylpyridine; 5-chloro-2,3-dihydroxypyridine; 3,5-diamino-2,6- dimethoxypyridine; 2-hydroxyethylamino-6-methoxy-

3-aminopyridine; 3,4- methylenedioxyaniline; 2,6-bis-hydroxyethoxy-3,5-  
diaminopyridine; 4- hydroxyindole; 3-amino-5-hydroxy-2,6-dimethoxypyridine; 5,6-  
dihydroxyindole; 7-hydroxyindole; 5-hydroxyindole; 2-bromo-4,5-  
methylenedioxyphenol; 6-hydroxyindole; 3-amino-2-methylamino-6- methoxypyridine; 2-  
5 amino-3-hydroxypyridine; 2,6-diaminopyridine; 5-(3,5-diamino-2-pyridyloxy)-1,3-  
dihydroxypentane; 3-(3,5-diamino-2-pyridyloxy)- 2-hydroxypropanol and 4-hydroxy-  
2,5,6-triaminopyrimidine, or combinations thereof.

## 10 BUFFERING AGENTS

The permanent hair coloring compositions of the present invention which are a  
mixture of Part A and Part B have a preferred pH in the range of from about 7.5 to about  
12, more preferably from about 8 to about 10.

15 Buffering agents may be present in part A compositions of the present invention  
which have a conditioner base, and compositions of the present invention which have a  
shampoo base. Coloring compositions of the present invention may contain one or more  
hair swelling agents (HSAs) such as urea, to adjust the pH to the desired level. Several  
20 different pH modifiers can be used to adjust the pH of the final composition or any  
constituent part thereof.

Further examples of suitable buffering agents are ammonium hydroxide, urea,  
ethylamine, dipropylamine, triethylamine and alkanediamines such as 1,3-  
25 diaminopropane, anhydrous alkaline alkanolamines such as, mono or di- ethanolamine,  
preferably those which are completely substituted on the amine group such as  
dimethylaminoethanol, polyalkylene polyamines such as diethylenetriamine or a  
heterocyclic amine such as morpholine as well as the hydroxides of alkali  
metals, such as sodium and potassium hydroxide, hydroxides of alkali earth metals,  
30 such as magnesium and calcium hydroxide, basic amino acids such as L-arginine,  
lysine, oxylysine and histidine and alkanolamines such as dimethylaminoethanol and

aminoalkylpropanediol and mixtures thereof. Also suitable for use herein are compounds that form  $\text{HCO}_3^-$  by dissociation in water (hereinafter referred to as 'ion forming compounds'). Examples of suitable ion forming compounds are  $\text{Na}_2\text{CO}_3$ ,  $\text{NaHCO}_3$ ,  $\text{K}_2\text{CO}_3$ ,  $(\text{NH}_4)_2\text{CO}_3$ ,  $\text{NH}_4\text{HCO}_3$ ,  $\text{CaCO}_3$  and  $\text{Ca}(\text{HCO}_3)_2$  and mixtures thereof.

As herein before described certain alkaline buffering agents such as ammonium hydroxide and monoethylamine (MEA) urea and the like can also act as hair swelling agents (HSA's).

Preferred for use as a buffering agent for the coloring compositions according to the present invention is ammonium hydroxide and/or sodium hydroxide.

In oxidizing and hair coloring kits comprising a portion of peroxide oxidizing agent, which may be present in either solid or liquid form, such as hydrogen peroxide, a buffering agent solution is required to stabilize hydrogen peroxide. Since hydrogen peroxide is stable in the pH range from 2 to 4, it is necessary to use a buffering agent having a pH within this range. Dilute acids are suitable hydrogen peroxide buffering agents. Phosphoric acid is a preferred agent for buffering hydrogen peroxide solutions.

This pH adjustment can be effected by using well known acidifying agents in the field of treating keratinous fibers, and in particular human hair, such as inorganic and organic acids such as hydrochloric acid, tartaric acid, citric acid, phosphoric acid and carboxylic or sulphonic acids such as ascorbic acid, acetic acid, lactic acid, sulphuric acid, formic acid, ammonium sulphate and sodium dihydrogenphosphate/phosphoric acid, disodium hydrogen phosphate/phosphoric acid, potassium chloride/hydrochloric acid, potassium dihydrogen phthalate/hydrochloric acid, sodium citrate/hydrochloric acid, potassium dihydrogen citrate/hydrochloric acid, potassium dihydrogencitrate/citric acid, sodium citrate/citric acid, sodium tartrate/tartaric acid, sodium lactate/lactic acid, sodium acetate/acetic acid, disodium hydrogenphosphate/citric acid and sodium chloride/glycine/hydrochloric acid and mixtures thereof.

## SOLVENTS

5 Water is the preferred principal carrier, solvent or diluent for the compositions according to the present invention. As such, the compositions according to the present invention may include one or more solvents as additional diluent materials. Generally, the solvent is selected to be miscible with water and innocuous to the skin. Solvents suitable for use herein include C<sub>1</sub> –C<sub>20</sub> mono- or polyhydric alcohols and their ethers, glycerine, with monohydric and dihydric alcohols and their ethers preferred. In these compounds, alcoholic residues containing 2 to 10 carbon atoms are preferred. Thus, a particularly preferred group includes ethanol, isopropanol, n-propanol, butanol, propylene glycol, ethylene glycol monoethyl ether, and mixtures thereof.

10  
15 These solvents may be present in compositions of the present invention which have a conditioner base, and in compositions of the present invention which have a shampoo base. These solvents may be present in part A compositions of the invention and part B compositions of the invention.

## 20 SURFACTANT MATERIALS

The compositions of the present invention can additionally contain a surfactant system. Suitable surfactants for inclusion in the compositions of the invention generally have a lipophilic chain length of from about 8 to about 22 carbon atoms. Surfactants which are either amphoteric or anionic or zwitterionic are included in compositions of the present invention which have a shampoo base. In addition, there may be included in shampoo compositions of the present invention, cationic, nonionic or zwitterionic surfactants. Compositions of the invention having a conditioner base can include cationic, nonionic or zwitterionic surfactants. Surfactants may be present in part A and part B compositions of the invention.

## (i) Anionic Surfactants

Anionic surfactants suitable for inclusion in the compositions of the invention include alkyl sulphates, ethoxylated alkylsulphates, alkyl glyceryl ether sulfonates, methyl acyl taurates, fatty acyl glycinate, N-acyl glutamates, acylisethionates, alkyl sulfosuccinates, alkyl ethoxysulphosuccinates, alpha-sulfonated fatty acids, their salts and/or their esters, alkyl ethoxy carboxylates, alkyl phosphate esters, ethoxylated alkyl phosphate esters, alkyl sulphates, acylsarcosinates and fatty acid/protein condensates, and mixtures thereof. Alkyl and/or acyl chain lengths for these surfactants are C12 - C22, preferably C12 -C18 more preferably C12 -C14.

## (ii) Nonionic Surfactants

The compositions of the invention can also comprise one or more water- soluble nonionic surfactants.

Suitable oil derived nonionic surfactants for use herein include water soluble vegetable and animal-derived emollients such as triglycerides with a polyethyleneglycol chain inserted; ethoxylated mono and di-glycerides, polyethoxylated lanolins and ethoxylated butter derivatives.

Preferred for use herein are polyethyleneglycol based polyethoxylated C<sub>9</sub> -C<sub>15</sub> fatty alcohol nonionic surfactants containing an average of from about 5 to about 50 ethyleneoxy moieties per mole of surfactant.

Also suitable for use herein are nonionic surfactants derived from composite vegetable fats extracted from the fruit of the Shea Tree (*Butyrospermum Karkii* Kotschy) and derivatives thereof. Similarly, ethoxylated derivatives of Mango, Cocoa and Illipe



butter may be used in compositions according to the invention. Although these are classified as ethoxylated nonionic surfactants it is understood that a certain proportion may remain as non-ethoxylated vegetable oil or fat.

5 Other suitable oil-derived nonionic surfactants include ethoxylated derivatives of almond oil, peanut oil, rice bran oil, wheat germ oil, linseed oil, jojoba oil, oil of apricot pits, walnuts, palm nuts, pistachio nuts, sesame seeds, rapeseed, cade oil, corn oil, peach pit oil, poppyseed oil, pine oil, castor oil, soybean oil, avocado oil, safflower oil, coconut oil, hazelnut oil, olive oil, grapeseed oil, and sunflower seed oil.

10  
15  
20  
25  
30  
35  
40  
45  
50  
55  
60  
65  
70  
75  
80  
85  
90  
95  
100  
105  
110  
115  
120  
125  
130  
135  
140  
145  
150  
155  
160  
165  
170  
175  
180  
185  
190  
195  
200  
205  
210  
215  
220  
225  
230  
235  
240  
245  
250  
255  
260  
265  
270  
275  
280  
285  
290  
295  
300  
305  
310  
315  
320  
325  
330  
335  
340  
345  
350  
355  
360  
365  
370  
375  
380  
385  
390  
395  
400  
405  
410  
415  
420  
425  
430  
435  
440  
445  
450  
455  
460  
465  
470  
475  
480  
485  
490  
495  
500  
505  
510  
515  
520  
525  
530  
535  
540  
545  
550  
555  
560  
565  
570  
575  
580  
585  
590  
595  
600  
605  
610  
615  
620  
625  
630  
635  
640  
645  
650  
655  
660  
665  
670  
675  
680  
685  
690  
695  
700  
705  
710  
715  
720  
725  
730  
735  
740  
745  
750  
755  
760  
765  
770  
775  
780  
785  
790  
795  
800  
805  
810  
815  
820  
825  
830  
835  
840  
845  
850  
855  
860  
865  
870  
875  
880  
885  
890  
895  
900  
905  
910  
915  
920  
925  
930  
935  
940  
945  
950  
955  
960  
965  
970  
975  
980  
985  
990  
995

(iii) Amphoteric Surfactants

Amphoteric surfactants suitable for use in the compositions of the invention include: alkyl betaines, alkyl sultaines, alkyl amphotoacetates, alkyl amphodiacetates, alkyl amphopropionates, and alkyl amphodipropionates.

(iv) Zwitterionic Surfactants

Water-soluble auxiliary zwitterionic surfactants suitable for inclusion in the compositions of the present invention include alkyl betaines

Water-soluble auxiliary sultaine surfactants suitable for inclusion in the compositions of the present invention include alkyl sultaines. Preferred for use herein is coco amido propylhydroxy sultaine.

Water-soluble auxiliary amine oxide surfactants suitable for inclusion in the compositions of the present invention include alkyl amines corresponding to the general formula  $R_1R_2R_3NO$ , wherein  $R_1$  contains an alkyl, alkenyl or monohydroxyl alkyl radical of from about 8 to about 18 carbon atoms, from 0 to about 10 ethylene oxide moieties,

and from 0 to about 1 glyceryl moiety, and  $R_2$  and  $R_3$  contain from about 1 to about 3 carbon atoms and from 0 to about 1 hydroxy group, e.g., methyl, ethyl, propyl, hydroxyethyl, or hydroxypropyl radicals. Preferred amine oxides include cocoamidopropylamine oxide, lauryl dimethyl amine oxide and myristyl dimethyl amine oxide.

#### (v) Cationic Surfactants

Cationic surfactants include polyethylene condensates of alkyl phenols, condensation products of ethylene oxide, propylene oxide, and ethylene oxide, propylene oxide, and ethylene diamine, long chain tertiary amine oxides, long chain tertiary phosphine oxides, and the like.

#### Conditioners

The conditioning compositions of this invention also may contain at least a water-soluble or water-dispersible quaternary nitrogen-containing conditioning agent that is also sometimes referred to herein as a cationic compound. A long chain fatty alcohol is also present in more preferred compositions, and a tertiary amidoamine is additionally present in particularly preferred compositions.

The quaternary nitrogen-containing conditioning agents are preferably present at from about 0.5 to about 5 percent by weight of the composition as an active ingredient. More preferably, the quaternary nitrogen-containing conditioning agent is present at from about 2 to about 3 weight percent, as an active ingredient.

A class of quaternary nitrogen-containing conditioning agents useful herein can contain one quaternary nitrogen atom having (a) two long aliphatic chains and (b) two identical or different short chain alkyl groups having one or two carbon atoms, each

bonded to the quaternary nitrogen atom. The two long chains each contain about 12 to about 18 carbon atoms.

Illustrative conditioning agents include distearyldimethylammonium chloride and dilauryldimethylammonium chloride. These compounds are named Quaternium-5 and Quaternium-47, respectively, in the CTFA Cosmetic Ingredient Dictionary, 2nd ed., 1977, published by the Cosmetic, Toiletry and Fragrance Association, Inc., hereinafter referred to as the CTFA Dictionary.

It is noted that the long aliphatic chain of the before-mentioned conditioning agents need not be solely or primarily of one chain length, i.e., the long chain need not be cetyl, myristyl, lauryl or stearyl. Rather, conditioning agents whose long aliphatic chain contains a mixture of lengths can be used. Such conditioning agents are conveniently prepared from naturally occurring materials, such as tallow, coconut oil, soya oil and the like, or from synthetically produced mixtures. Examples of useful conditioning agents having mixed aliphatic chain lengths include dimethyldi-(hydrogenated tallow)ammonium chloride and dialkyldimethylammonium chloride wherein each alkyl group is a saturated group consisting primarily of 16 carbon atoms. These quaternary nitrogen-containing conditioning agents are named Quaternium- 18 and Quaternium-31, respectively, in the CTFA Dictionary.

The compositions of this invention can also be in the form of emulsions that contain additional amounts of hydrophilic and/or hydrophobic ingredients. Emulsions containing additional hydrophobic materials are particularly preferred. It is preferred that those emulsions be stable to phase separation at a temperature of about 25 degrees C. for a period of about 24 hours after their preparation. The emulsions are more preferably stable to phase separation at temperature normally found in commercial product storage and shipping for periods of one year or more.

## THICKENERS

Thickeners may be included in compositions of the invention which have a  
5 shampoo base, and compositions of the invention which have a conditioner base, and  
thickeners may be included in part A and part B compositions of the invention. Long  
chain fatty alcohols having from about 11 to about 18 carbon atoms in the long fatty  
chain can be thickener constituents of the conditioning emulsions of this invention.  
These alcohols can be used alone, or in admixture with each other. When included in  
10 the compositions of the invention, the alcohol is preferably present at from about 0.5 to  
about 10 weight percent of the composition, and more preferably at from about 2 to  
about 5 weight percent.

Lauryl alcohol, oleyl alcohol, myristyl alcohol, stearyl alcohol, and the like, and  
15 mixtures thereof are contemplated herein. In addition, mixtures of natural or synthetic  
fatty alcohols having fatty chain lengths of from about 11 to about 18 carbons are also  
useful. Several such mixtures are available commercially, and are exemplified by the  
material containing a mixture of synthetic alcohols with 12 to 15 carbons in the alkyl  
chain sold under the trademark NEODOL 25 by Shell Chemical Company, and the  
20 material containing a mixture of synthetic alcohols with chain lengths of 12 to 16  
carbons sold under the trademark ALFOL 1216 Alcohol by Conoco Chemicals.

Thickening agents suitable for use in the compositions herein may also be  
selected from oleic acid, cetyl alcohol, sodium chloride, cetearyl alcohol, stearyl alcohol,  
25 synthetic thickeners such as Carbopol, Aculyn and Acrosyl and mixtures thereof.  
Preferred thickeners for use herein are Aculyn 22 (RTM), steareth-20 methacrylate  
copolymer; Aculyn 44 (RTM) polyurethane resin and Acusol 830 (RTM), acrylates  
copolymer that are available from Rohm and Haas, Philadelphia, Pa., USA. Additional  
thickening agents suitable for use herein include sodium alginate or gum arabic, or  
30 cellulose derivatives, such as methyl cellulose or the sodium salt of  
carboxymethylcellulose or acrylic polymers.

Fatty alcohols of the above discussed carbon chain lengths which are ethoxylated to contain an average of one or two moles of ethylene oxide per mole of fatty alcohol can be used in place of the fatty alcohols themselves. Examples of such useful ethoxylated fatty acids include ethylene glycol cetyl ether, polyoxyethylene (2) stearyl ether, and the like; the exemplary compounds having CTFA Dictionary names of Ceteth-1 and Steareth-2, respectively.

## OPTIONAL INGREDIENTS

The compositions of the present invention can comprise a wide range of optional ingredients. These ingredients can be classified into functional groups such as: anticaking agents, antioxidants, binders, biological additives, bulking agents, chelating agents, chemical additives, colorants, cosmetic astringents, cosmetic biocides, denaturants, drug astringents, emulsifiers, film formers, fragrance components, humectants, opacifying agents, plasticizers, preservatives, propellants, reducing agents, solvents, foam boosters, hydrotropes, solubilizing agents, suspending agents (nonsurfactant), sunscreen agents, ultraviolet light absorbers, and viscosity increasing agents (aqueous and nonaqueous). Examples of other functional classes of materials useful herein that are well known to one of ordinary skill in the art include solubilizing agents, sequestrants, and the like.

Other optional ingredients include organic acids. A non-exclusive list of examples of organic acids which can be used as the proton donating agent are adipic acid, tartaric acid, citric acid, maleic acid, malic acid, succinic acid, glycolic acid, glutaric acid, benzoic acid, malonic acid, salicylic acid, gluconic acid, polyacrylic acid, their salts, and mixtures thereof. Non-exclusive lists of examples of mineral acid for use herein are hydrochloric acid, phosphoric acid, sulfuric acid and mixtures thereof.

It has been found by experimentation that daily hair care products can achieve permanent or durable desired hair color. As noted above, the daily hair care product consists of two parts.

Part A: an oxidation hair dye in a conditioner or shampoo base at alkaline pH

Part B: an oxidative compound such as hydrogen peroxide in a conditioner or shampoo base at acidic pH

Part A is mixed with part B and applied to hair. The reason conventional hair coloring products come in two packages is because the mixture of the coloring component and the oxidizing component is unstable and the two components must be kept apart until just before use. Similarly part A and part B of the present invention must be kept apart until just before use. By varying the concentration of the actives and the treatment time, the amount of color on hair can be varied while minimizing hair damage. To make the product more convenient and fool proof, part A and part B can be packaged in dual dispensing systems where both parts are mixed outside of the package. The mixture is then applied to the wet hair as a conditioner or shampoo. Depending upon the amount of color desired, the treatment time could be varied from two minutes to longer amounts of time.

Such conditioner or shampoo treatments add permanent color to hair gradually without damage to the hair due to lower contact time with the hair. Each subsequent treatment would add color until the desired shade is obtained. Depending upon the concentration of the actives and contact time, a desired shade may be reached in about six to about eight treatments. It has been found that since any one treatment does not exceed the threshold of irreversible damage, the total damage resulting from multiple treatments is lower than the damage from a single conventional treatment. Such a process gives the user control on the amount of color deposited on his or her hair, and also the option to discontinue further applications if the color delivered is not to his or her liking. He or she also has the option to switch to another color shade immediately without having to wait the six to eight weeks that is recommended for conventional

treatments. With conventional hair color treatment, it is not recommended to perm and color hair simultaneously due to extensive damage. However, since this method colors the hair with minimum damage, perming can be done in the same time frame with this progressive permanent hair coloring treatment.

5

## METHOD FOR USING COMPOSITIONS OF THE INVENTION

Shampoo the hair as usual. Pump the composition of the invention into the palm and mix. Apply product to the hair like a regular conditioner. Rinse the hands. Leave product in the hair for about 2 minutes for color maintenance to about 5 minutes for color change. Rinse the hair thoroughly.

The following examples, which were made, are shown as illustrations only, and are not intended to limit the scope of the invention:

## EXAMPLE 1

## Dark Brown Color conditioner: Part A

5	1. DI (deionized) Water	70.00
	2. Stearamidopropyl dimethylamine	0.50
	3. Dicetyldimonium chloride/PG, 68%/27%	2.10
	4. Stearyl alcohol and Ceteareth-20, 70%	1.00
10	5. Cetyl alcohol	3.60
	6. DI water	3.00
	7. Disodium EDTA	0.10
	8. Dimethicone 100%	1.00
	9. DC silicone fluid 245	1.80
15	10. Preservatives	0.18
	11. DMDM Hydantoin 55%	0.10
	12. Fragrance	0.20
	13. Sodium metabisulfite	0.10
	14. DI water	15.11
20	15. m- Aminophenol	0.03
	16. N,N Bis(2-hydroxyethyl)-p-phenylenediamine sulfate	0.13
	17. p-Phenylenediamine	0.45
	18. o-Aminophenol	0.05
	19. Resorcinol	0.25
25	20. Sodium hydroxide 50%	0.40

PH= 8 to 9



## Manufacturing Process:

Weigh the ingredients (item#15 to 19) needed into an appropriate container;

5 Flush the container (tank) with nitrogen gas;

Add item #1 into a suitable container. Heat to 180-185F, Keep the Nitrogen blanket;

Add pre-weighed dyes with moderate agitation. Keep the Nitrogen blanket;

Add item #3 with moderate agitation;

Add items #2, 4 and 5, dissolve completely;

10 Mix batch at approximately 180-185F for at least an hour with agitation until particles;  
are completely dissolved. Check for the particles;

Begin cooling. Keep the nitrogen blanket with moderate agitation;

Prepare EDTA and sodium phosphate solution using item#7 DI water;

At 130F add the EDTA solution to the batch;

15 At 110F or below, add items # 8, 9,10,11,12; mix well;

Adjust the pH to around 10.0; keep the Nitrogen blanket through entire process;

Qs with DI water(item#14).

## EXAMPLE 1 (continued)

## Peroxide conditioner: Part B

5

1. D.I. Water	74.00
2. Liquid Citric acid, 50%	0.20
3. Stearamidopropyl dimethylamine	0.50
4. Dicetyldimonium chloride/PG, 68%/27%	2.10
5. Stearyl alcohol and Ceteareth-20, 70%	1.00
6. Cetyl alcohol	3.80
7. DI water	5.00
8. Disodium EDTA	0.10
9. Dimethicone 100%	1.00
10. DC silicone fluid 245	1.80
11. Hydrogen Peroxide(35%)	10.00
12. DMDM Hydantoin 55%	0.10
13. Fragrance	0.20
14. Phosphoric acid, 85%	0.09

20

pH=2.5 to 3.5

## MANUFACTURING PROCESS:

1. Add item#1 into a suitable container. Heat to 180-185F
2. Add item#2 with moderate agitation
3. Add item#4, dissolve completely
4. At 165-170F, add item#3,5,6
5. Mix batch at approximately 180-185F for at least an hour with agitation until particles are completely dissolved. Check for the particles
6. Begin cooling.
7. In a separate container dissolve item#8 in item#7)
8. At 130F add the EDTA solution to the batch.
9. At 110F or below, add item# 9, 10, 11, 12, and 13 Mix well
10. Adjust the pH with item#14 to 2.7 to 3.0
11. Qs with water

## Experiment: METHOD OF USING ABOVE CONDITIONERS:

Shampoo the hair tresses. Take equal part of color conditioner of part A and B (formula#1), mix and apply to the wet hair tresses, keep for two minutes, and rinse well.

Repeat the above procedure for subsequent treatment. Collect the hair tress after 2, 4 and 6 treatments. Measure the change in color delta E using McBeth ColorEye.

Color the hair tresses using L'Oreal dark brown permanent hair color. Follow the instruction sheet. Measure the change in color delta E using McBeth ColorEye.

5 The changes in Delta E values are summarized in below table. One can see from the results that change in color after one 30-min. treatment with L'Oreal Dark Brown is very similar to six- 2-min. treatment of color conditioner. The good correlation was observed with number of treatment and change in the color of the hair. It takes six treatments to achieve a single 30 minutes treatment of permanent color.

10

	L'Oreal's Preference: Dark Brown: Delta E	Invention: Dark Brown (Ex. 1) Delta E
1 treatment -30 min.	4.19	
2 treatments-2 min. each		1.68
4 treatments-2 min. each		3.45
6 treatments-2 min. each		4.02

15 It can be seen that six treatments of two minutes per each treatment with the dark brown color composition of the present invention, resulted in approximately the same color change, Delta E, as one thirty minute treatment with L'Oreal's dark brown color composition.

## Experiment - Wet combing measurements

The combing experiment was been carried out to evaluate the extent of damage.

5 Wet combing evaluation technique has been used to correlate damage. Lower wet combing force indicates less damage. The above tresses were evaluated via Instron to measure combing force.

10 Results indicated that the tresses treated with L'Oreal dark brown required much higher combing force than tresses treated with color conditioner.

15 To evaluate the wet combing performance of a Dark Brown (Ex. 1) and Light Brown (Ex. 3) Color Conditioner of the invention the measurements below were made. The combing force of hair treated 30 times with Light Brown composition was measured and compare with combing force of hair treated with one treatment of L'Oreal Preference. Also, tensile strength damage caused by the composition of the invention was compared to tensile strength damage caused by a commercial color product (Preference by L'Oreal). Wet combing experiments have been carried out on the Instron 5500 series. All testing was carried out by applying 0.3 mL of product to  
20 bleached and waved 2 g hair tresses. Results are expressed in terms of the maximum load (highest force encountered during combing) and combing energy (area under the combing curve). Finesse extra moisturizer and Extra body have also been included in this study as internal controls. Wet combing results are given below.

Statistical analysis is presented in terms of the Tukey HSD test and the less rigorous LSD test.

#### 5 Multiple Range Tests for M\_Ld by Treatment

Method: 95.0 percent Tukey HSD

Treatment	Count	Mean		Homogeneous Groups
Example No. 1	8	9.14	X	Example No. 1, Dark brown
Fin_M	8	9.645	X	Finesse Moisturizing
Fin_B	8	13.5813	X	Finesse Bodifying

#### 15 Multiple Range Tests for M\_Ld by Treatment

Method: 95.0 percent LSD

Treatment	Count	Mean		Homogeneous Groups
Example No. 1	8	9.14	X	Example No. 1, Dark brown
Fin_M	8	9.645	X	Finesse Moisturizing
Fin_B	8	13.5813	X	Finesse Bodifying

## Multiple Range Tests for T\_Energy by Treatment

Method: 95.0 percent Tukey HSD

5	Treatment	Count	Mean		Homogeneous Groups
	Example No. 1	8	8.40875	X	Example No. 1, Dark brown
	Fin_M	8	9.35875	X	Finesse Moisturizing
	Fin_B	8	12.4	X	Finesse Bodifying

## Multiple Range Tests for T\_Energy by Treatment

Method: 95.0 percent LSD

15	Treatment	Count	Mean		Homogeneous Groups
	Example No. 1	8	8.40875	X	Example No. 1, Dark brown
	Fin_M	8	9.35875	X	Finesse Moisturizing
	Fin_B	8	12.4	X	Finesse Bodifying

The above data indicate that the combing force of Dark brown composition is very similar to the standard Finesse moisturizing conditioner. Higher combing force indicates difficult to comb.

Statistical analysis is presented in terms of the Tukey HSD test and the less rigorous LSD test.

#### 5 Multiple Range Tests for Max\_Ld by Treatment

Method: 95.0 percent Tukey HSD

Treatm	Count	Mean	Homogeneous Groups	
Untreated	8	19.4125	X	Untreated
Rainbow 30x	8	19.7013	X	Invention Light Brown Conditioner Example No. 3, 30x
L'Oreal	8	53.4988	X	L'Oreal <i>Preference</i>

#### 15 Multiple Range Tests for Max\_Ld by Treatment

Method: 95.0 percent LSD

Treatment	Count	Mean	Homogeneous Groups	
Untreated	8	19.4125	X	Untreated
Invention 30x	8	19.7013	X	Invention Light Brown Conditioner Example No. 3, 30x
L'Oreal	8	53.4988	X	L'Oreal <i>Preference</i>

25 The above data indicate that the combing force of hair treated 30 times with Light brown composition is very similar to the untreated hair tresses. However, the combing force of hair treated with one treatment of L'Oreal is much higher than hair treated with Light Brown compositions. Again, as mentioned, higher combing force indicates difficult to comb and higher damage.

30



## Experiment: TENSILE TESTING

All tensile testing has been carried out on the Diastron MTT600. The tensile strength of approx. 50 individual fibers were measured for each treatment. The diameter of these individual fibers is measured prior to testing to allow the force to be normalized against cross sectional area.

That is :  $\text{Stress} = \text{Force} / \text{Cross sectional area}$

The tensile properties of hair may be taken to reflect the extent of structural integrity. Various measurements may be used to assess these tensile properties. Common parameters include the stress at break, work to break or extension to break. The complex structural properties of hair dictate that the wet and dry tensile properties reflect the properties of different regions. Wet tensile properties may be regarded as being representative of the alpha helical keratin protein within the hair's microfibrils; while the dry tensile properties also includes a substantial contribution from the intercellular cement. Many previous sets of results have shown that changes in tensile properties as a function of a treatment are more often seen when considering the wet tensile properties. For this reason, these experiments represent measurement of the wet tensile properties of the various hair treatments.

Each set of crimped hair samples was soaked in water for 30 mins prior to testing. In addition, the slots in the tensile testing carousel were filled with water to ensure that the fibers remained soaked for the progression of the experiment. All tensile treatments were carried out by the requester.

Break stress results are shown below.

Statistical analysis is again presented in terms of the Tukey HSD test and the less rigorous LSD test.

## Multiple Range Tests for B\_STRESS by TREATMENT

---

Method: 95.0 percent Tukey HSD Break Stress (gm force/micron<sup>2</sup>)

5	TREATMENT	Count	Mean	Homogeneous Groups	
<hr/>					
	L'OREAL	45	0.0170723	X	L'Oreal Preference, Dark Brown
	UNTREATED	45	0.0182494	X	Untreated
	Example No. 2	40	0.0185977	X	Example No. 1 - Dark Brown

10  
3456789101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899100

## Multiple Range Tests for B\_STRESS by TREATMENT

Method: 95.0 percent LSD      Break Stress (gm force/micron<sup>2</sup>)

5 TREATMENT	Count	Mean	Homogeneous Groups	
L'OREAL	45	0.0170723	X	L'Oreal Preference, Dark Brown
UNTREAT	45	0.0182494	X	Untreated
Example No. 1	40	0.0185977	X	Example No. 1

10  
15 The above results would seem to be suggesting that the chemical treatment L'Oreal Preference color has lowered the break stress, while the conditioner of the invention has had no effect on this tensile parameter remains as untreated. It indicates that hair treated with L'Oreal preference is easier to break compare to the untreated hair and the hair treated with conditioner of the invention.

20 The table below summarized the part A formulation for various shades. One can use same peroxide conditioner part B for all shades.

	Hair Color Conditioner: Part A					
Ingredients	Dark	Light	Dark	Light	Dark	Light
	Brown	Brown	Blonde	Blonde	Auburn	Auburn
Example No.	2	3	4	5	6	7
Deionized water	70.00	70.00	70.00	70.00	70.00	70.00
Stearamidopropyl dimethylamine	0.50	0.50	0.50	0.50	0.50	0.50
Dicetyldimonium chloride	2.10	2.10	2.10	2.10	2.10	2.10
Stearyl alcohol and Cetareth-20	1.00	1.00	1.00	1.00	1.00	1.00
Cetyl alcohol	3.60	3.60	3.60	3.60	3.60	3.60
Disodium EDTA	0.10	0.10	0.10	0.10	0.10	0.10
Sodium phosphate	-	0.20	0.20	0.20	-	0.20
Deionized water	18.41	18.65	19.32	15.00	17.99	15.00
Fragrance	0.20	0.20	0.20	0.20	0.20	0.20
Dimethicone	0.10	0.10	0.10	0.10	0.10	0.10
Cyclopentasiloxane	1.80	1.80	1.80	1.80	1.80	1.80
Preservatives	0.18	0.18	0.18	0.18	0.18	0.18
Sodium metabisulfite	0.15	0.15	0.15	0.15	0.15	0.15
4-amino-2-hydroxytoluene (p-amino-o-cresol)PAOC	-	-	-	-	0.70	0.70
m-aminophenol: Rodol EG	0.03	-	-	-	-	-
o-aminophenol: Rodol 2G	0.05	0.01	0.05	0.03	0.20	0.10
p-aminophenol: Rodol P base	-	-	0.05	0.03	0.20	0.30
N,N Bis(2-hydroxyethyl)-p-phenylenediamine sulfate:HED	0.13	-	-	-	-	-
2-methylresorcinol:RodolMRP	-	-	-	-	-	-
1-Napthol:Rodol ERN	-	-	-	-	-	-
p-phenylenediamine:Rodol D type J	0.70	0.35	0.02	0.01	0.15	0.03
Resorcinol:Rodol RS	0.35	0.45	0.03	0.01	0.03	0.03
Phenyl methyl pyrazolone(Rodol PMP	-	0.01	-	-	-	-
HC Red#3	-	-	-	-	0.20	0.02
Sodium hydroxide, liquid 50% active	0.4-0.6	0.4-0.6	0.4-0.6	0.4-0.6	0.4-0.6	0.4-0.6
Mixed pH=	7.5-8.0	9.0-9.5	9.0-9.5	9.0-9.5	8.0-8.5	9.0-9.5

## EXAMPLE 8

The following is the example of formulation of Dark brown Coloring Shampoo:

## Part A

5	Item	Ingredients	Dark Brown
	1	Deionized water	60.00
10	2	Polymer JR	0.30
	3	Cocamidopropyl betaine	7.00
	4	SCAP	25.00
	5	DC-1870 HV	0.08
	6	Propylene glycol	0.30
15	7	Versene 100	0.20
	8	Fragrance	0.20
	9	Kathon CG(1.5% active)	0.08
	10	DMDM hydantoin	0.10
	11	Sodium metabisulfite	0.15
20	12	m-aminophenol:Rodol EG	0.03
	13	o-aminophenol:Rodol 2G	0.05
	14	N,N Bis(2-hydroxyethyl)-p-phenylenediamine sulfate:HED	0.13
	15	p-phenylenediamine:Rodol D type J	0.70
	16	Resorcinol:Rodol RS	0.35
25	17	Sodium hydroxide, liquid 50% active	0.4-0.6

pH= 7.5-8.0

Viscosity= 3000 to 6000cps(spindle#4, 20 rpm)

### Manufacturing Process:

- 5 Weigh the ingredients (item#11 to 16) needed into an appropriate container  
Flush the container (tank) with nitrogen gas  
Add item#1 into a suitable container. Heat to 180-185F, Keep the Nitrogen blanket  
Add pre-weighed dyes with moderate agitation. Keep the Nitrogen blanket  
Add item#2 with moderate agitation
- 10 Add item#3, and 4 dissolve completely  
Mix batch at approximately 180-185F for at least an hour with agitation until particles  
are completely dissolved. Check for the particles  
Begin cooling. Keep the nitrogen blanket with moderate agitation  
At 130F add the Versene solution to the batch.
- 15 At 110F or below, add item# 5,6,8,9,10, Mix well  
Adjust the pH with item#17 to around 10.0 Keep the Nitrogen blanket through entire  
process  
Qs with DI water

## EXAMPLE 8 (continued)

## Part B: Peroxide Shampoo

Item#	Chemical Name	Actual Weight%
1	D.I. Water	39.00
2	Polymer JR 30M	0.30
3	Sodium C14-C16 Olefin Sulfonate	35.00
4	Lauramine oxide 29%	3.70
5	Lauryl alcohol	0.50
6	DC-1870 HV	1.60
7	DI water	9.00
8	DMDM Hydantoin 55%	0.10
9	Hydrogen peroxide, 35%	10.00
10	Fragrance	0.20
11	Phosphoric acid, 85%	0.60

Specification:

pH= 2.7 to 3.0

Viscosity= 3000 to 6000cps(spindle#4, 20 rpm)

Manufacturing Process:

1. Add item#1 into a suitable container. Heat to 180-185F
2. Add item#2 with moderate agitation
3. At 165-170F, add item#3,4,5,
4. Mix batch at approximately 160-165F for at least an hour with agitation until particles are completely dissolved. Check for the particles
5. Begin cooling.
6. At 110F or below, add item# 6,7,8,9,10 Mix well
7. Adjust the pH with item#1 to 2.7 to 3.0
8. Qs with water



The composition resulting from the mixing the developer composition; and the dye composition has a pH of greater than or equal to 7.5. This mixture is applied to the hair. After a period ranging from 2 to 30 minutes, the hair is rinsed with water, optionally  
 5 treated with an after treatment composition, and the rinsed with water again.

Without wishing to be bound by theory, it is believed that the following mathematical formulas describe the color change results and the hair damage results, which are obtained through the use of the compositions and methods of the present  
 10 invention.

Final color                      concentration  
 Change result        = of dyestuff        + pH    + contact time    + number of treatments.

15 Hair damage    = (pH + concentration of oxidizing agent) times the contact time; with the proviso that when the contact time is about two minutes or less, then there is no appreciable hair damage no matter how high the number of treatments.

20 Thus, if the contact time is kept at about two minutes or below for each treatment with compositions of the invention then there is no appreciable hair damage no matter how many color application treatments according to the invention are performed.

The following examples, which were made, are shown as illustrations only and  
 25 are not intended to limit the scope of the invention:

## EXAMPLE 9

## Light Brown Color Conditioner: Part A

5

1. DI Water	70.00
2. Stearamidopropyl dimethylamine	0.50
3. Dicetyldimonium chloride/PG, 68%/27%	2.10
4. Stearyl alcohol and Ceteareth-20, 70%	1.00
5. Cetyl alcohol	3.60
6. DI water	3.00
7. Disodium EDTA	0.10
8. Dimethicone 100%	1.00
9. DC silicone fluid 245	1.80
10. Kathon CG 1.5%	0.08
11. DMDM Hydantoin 55%	0.10
12. Fragrance	0.20
13. Sodium metabisulfite	0.10
14. DI water	15.11
15. p-Phenylenediamine	0.35
16. o-Aminophenol	0.01
17. Resorcinol	0.45
18. Phenyl methyl pyrozolone	0.01
19. Sodium hydroxide 50%	0.40

25

PH= 8 to 9

## Light Brown Color conditioner: Part B

	1. D.I. Water	74.00
5	2. Liquid Citric acid, 50%	0.20
	3. Stearamidopropyl dimethylamine	0.50
	4. Dicetyldimonium chloride/PG, 68%/27%	2.10
	5. Stearyl alcohol and Ceteareth-20, 70%	1.00
	6. Cetyl alcohol	3.80
10	7. DI water	5.00
	8. Disodium EDTA	0.10
	9. Dimethicone 100%	1.00
	10. DC silicone fluid 245	1.80
	11. Hydrogen Peroxide(35%)	10.00
15	12. DMDM Hydantoin 55%	0.10
	13. Fragrance	0.20
	14. Phosphoric acid, 85%	0.09

PH=3.0

Take equal part of color conditioner of part A and B (formula#1), mix and apply to the hair tresses, keep for 30 minutes, and rinse well. Measure the change in color delta E using McBeth ColorEye.

EXAMPLE 10Part A:5 Light Brown using conventional color base:

1. Laureth-4	12.40
2. Neodol 23	19.10
3. Oleth-10	28.90
10 4. Hexylene glycol	13.00
5. Hamp-ene-acid	0.10
6. Isoascrobic acid	0.10
7. Fragrance	0.20
8. Sodium metabisulfite	0.10
15 9. p-Phenylenediamine	0.35
10. o-Aminophenol	0.01
11. Resorcinol	0.45
12. Phenyl methyl pyrozolone	0.01
13. Sodium hydroxide 50%	0.40
20 14. DI water	

PH= 8 to 9

## Part B:

## Peroxide solution:

1.	D I water	78.00
2.	Hydrogen peroxide 35%	18.0
3.	Polysorbate-20	1.0
4.	Polyquat-6	1.0

PH= 3.0

Method of using above Hair coloring products:

Experiment

## Gradual color delivery

Shampoo the blonde hair tresses. Take equal part of color conditioner of part A and B , mix and apply to the wet hair tresses, keep for two minutes, and rinse well.

Repeat the above procedure for subsequent treatment. Collect the hair tress after 2, 4 and 8 treatments. Measure the change in color delta E using McBeth ColorEye.

Similarly, Shampoo the blonde hair tresses. Take equal part of color conditioner of part A and B (formula#2), mix and apply to the wet hair tresses, keep for two minutes, and rinse well. Repeat the above procedure for subsequent treatment. Collect the hair tress after 2, 4 and 8 treatments. Measure the change in color delta E using McBeth ColorEye.

Conventional	Invention: Light Brown
Hair color: Light Brown:	Delta E
Delta E	

2 treatments-2 min. each	20.02	29.1
4 treatments-2 min. each	24.27	34.68
8 treatments-2 min. each	31.18	44.55

The above results indicates that a composition of the new invention deposits 30% more color than conventional hair color composition.

## Experiment

### Treatment product

The new composition can be used as a treatment product also. The result of the following experiment suggests that new conditioner base deposits about 30% more color than conventional surfactant base. Along with this, the new base gives very little damage compare to conventional base. A post treatment conditioner is therefore not needed. However, with conventional base, one would need post treatment conditioner.

Take equal amounts of color conditioner of part A and B (formula #1), mix and apply to the hair tresses, leave on the hair tresses for 30 minutes, and rinse well. Measure the change in color delta E using McBeth ColorEye.

The changes in delta E values are summarized in below table. It can be seen from the results that the change in color after one 30-minute treatment with the base of the invention is about 30% higher than color developed by a conventional base.

	Conventional color base:	New invented base
	Light brown Delta E	Light Brown Delta E
1X-30 mins.	33.085	44.485

Treatment of hair with compositions of the invention as described herein gives said hair good attributes such as lower wet combing force, higher break stress, lower amounts of cysteic acid (which are an indicator of hair damage), good hair color change, less color fading, less damage to hair, and more intense color to hair as described just below. Also described below is a method for applying composition of the invention at set time intervals so as to avoid root outgrowth, and less color fading

#### Combing index-

The combing experiment has been carried out to evaluate the extent of damage.

Wet combing evaluation technique has been used to correlate damage. The combing index was measured to evaluate the extent of damage. Higher index (more than one) number indicate lower damage.

Combing index = Combing force of untreated hair/ combing force of treated with color shampoo

The above tresses were evaluated via Instron to measure combing force.

Treatments	Combing force
------------	---------------

Untreated hair	26.15
----------------	-------

Treated with color conditioner	9.25
--------------------------------	------

Combing index = Combing force of untreated hair/ combing force of treated with color shampoo

$$= 26.15/9.25$$

$$= 2.82$$

Wet combing force:

After conventional hair color treatment, it is hard to comb the hair. Harder combing indicates the more hair damage. The combing force was measured using Instron.

The combing force with new conditioner composition would in the range of 5 to 55 gm force, preferably 5 to 20 and more preferably 5 to 10 gm force.

Break stress:

After conventional hair color treatment, the hair becomes weak and easy to break. The weak hair is again a sign of damage. The strength of the hair was measured using Instron.



The break stress with a conditioner composition of the invention would be in the range of 0.005 to 0.03 gm force/micron, preferably 0.005 to 0.025, and more preferably 0.005 to 0.018 gm force/micron.

5

Cysteic acid:

Much of the hair damage associated with conventional hair color treatment comes from the oxidation of cystine residues to the corresponding cysteic acid, with a consequent decrease in the tensile strength of hair as these cross-linkages are destroyed. A good measure of oxidative damage is thus the amount of cysteic acid formed in hair.

10

Infrared transmission spectroscopy has been used to determine cysteic acid content in hair. The ratio of absorption at 1040 cm<sup>-1</sup>/absorption at 1240 cm<sup>-1</sup> would indicate the extent of damage. Lower the ratio indicates less hair damage.

15

The ratio of 1040/1240 with new color compositions would be in the range of 0.01 to 1.5, preferably 0.01 to 1.0, and more preferably 0.01 to 0.5

20

Total hair damage:

Hair damage done by hair coloring compositions can be calculated according to the following mathematical formulas:

25

% Damage = Chemical damage X Physical damage

% Damage = amount of cysteic acid X combing force gm X breaking stress  
forcegm/micron<sup>2</sup> X 100

30

% Damage using L'Oreal's conventional preference permanent hair color for example =

$$0.75 \times 48 \times 0.02 \times 100$$

$$= 72 \% \text{ damage}$$

% Damage using new hair color composition:

$$0.25 \times 20 \times 0.015 \times 100$$

$$= 7.5\% \text{ damage}$$

The above numbers indicate that the hair color compositions of the invention damage the hair to a much extent than conventional permanent hair color. The invention relates to a method for adding color to hair which involves causing about 5 to about 10% damage to said hair per week, based on the above formulas and depending on the frequency of use.

Color change/color control:

The conventional permanent hair color system gives the color change delta E of 5 to 65 on blonde hair, and color change up to delta E of 1 to 8 on brown hair with one treatment. In conventional hair coloring treatments, consumers have little or no control of color, control of hue and control of lightening.

With the composition of the invention and its method, there can be delivered delta E of 0.1 to 65 on blonde hair and delta E of 0.1 to 8 on brown hair.

When a dark brown color composition of the present invention is applied to dark brown hair, then after one application there can be a delta E from about 0.1 to about 0.2.

When a dark brown color composition of the present invention is applied to virgin blonde hair, then after one application there can be a delta E from about 10 to about 30.

When a dark brown color composition of the present invention is applied to bleached blonde hair, then after one application there can be a delta E from about 20 to about 40.

Root outgrowth:

A conventional permanent hair color system is used once in 4 to 6 weeks. During this time due to the new hair growth, roots look totally different than rest of the hair. On average the hair grow 1 cm /month or 0.3 mm/day.

With the present compositions and methods, using said compositions as conditioners, one would add color on each application of said compositions. Laboratory evaluation indicates that one would add 10 % of the color change per conditioning treatment.

The amount of color added is determined by the following mathematical formulas.

The length of the new hair = 0.3 mm X no. of days

% color added to new hair (10days) = No of days X % color added per day  
= 10 X 10%= 100% color

Due to the constant addition of the color 10% per day, one will not be able to see root outgrowth.

The invention relates to a method for adding color to hair which involves adding to said hair about 5 to about 10%, preferably about 4 to about 8% color per day, based on the above formulas and depending on the frequency of use.

#### Color fading:

A conventional permanent hair color system is used once in 4 to 6 weeks. During this time color fades with washing, and outside exposure due to the weathering effect.

The amount of color fading will depend upon washing and outside exposure.

Assuming that person washes his/her hair 4 times a week and exposes him/herself to outside conditions, for 2.0 hrs a day, the percentage of the color loss can be calculated using following equation.

Laboratory evaluation indicates that one would lose 1% of the color per wash and would lose about 0.75% of the color/hr of outside exposure.

$$\% \text{ Loss of color} = \text{no. of washing} \times \% \text{ color loss/wash} + \text{no of hrs. of exposure} \times \% \text{ color loss/hr}$$

$$\begin{aligned} \% \text{ Loss of color per month} &= 20 \times 1.0 + 40 \text{ hrs} \times 0.75 \\ &= 20 + 30 = 50\% \end{aligned}$$

$$\% \text{ Loss of color per week} = 12.5\%$$

So, on average a consumer would lose 50% of the hair color. That is why most consumers want to recolor their hair every 4 to 6 weeks.

With the present composition and methods, one would add color on each application of composition, according to the schedule set forth by the following mathematical formulas.

% Color addition/week = no of conditioning treatment week X amount color added/treatment

5 Laboratory evaluation indicates that one would add 6 % more color per conditioning treatment.

% Color addition/week = 3 X 10% = 30%

10 With new composition, we would lose 12.5% of the color but we would add 30% of the color. Due to this, one would not see any fading of the color and color stays fresh everyday.

15 The invention relates to a method for reducing the color fading of hair to about 0 to about 10% per week, based on the above formulas and depending on the frequency of use.

20 More intense color:

25 The typical permanent color composition, upon application goes through an oxidation mechanism. Each of the dye intermediates can produce pigments through oxidation and polymerization. According to Le Chatelier's principle, the state of a chemical reaction is a dynamic state in which the chemical reaction is occurring in both directions. The rate of reaction depends upon the ratio of the rate of forward reaction to the rate of backward reaction. The higher the ratio the faster is the reaction. The factors affecting the rate of reactions are as follows:

1. Reactants
2. Products
- 30 3. Pressure
4. Temperature.

A main difference in the reaction of method of using conventional permanent color system and new invented system is the temperature. With the conventional system, the reaction takes place at room temperature, at about 70 to 75F, while with new system, since it is used in the shower, the reaction takes place at higher temperatures of about 100 to 110F. According to Le Chatelier's principle, the effect of temperature is very significant to the final rate of reaction.

Under identical conditions, laboratory evaluation indicates that one would increase intensity of the color 5% with 10F-temperature difference.

Therefore, according to the mathematical formula just below, 15% more color is added using the compositions and methods of the invention as opposed to conventional hair coloring methods.

$$\begin{aligned}
 \% \text{ Additional Color} &= \Delta T \times \% \text{ change in color per one degree F difference} \\
 &= (100F - 70F) \times 0.5 \\
 &= 30 \times 0.5 = 15\% \text{ more color due to new method}
 \end{aligned}$$

At the same time that hair damage is avoided by the methods of the invention, the consumer's hair is gradually being brought to the desired shade and color. This gradual change of color has two advantages: first, since the color is changed gradually, the consumer can stop the process if he or she does not like the color his or her hair is turning to. Second, some consumers do not want an abrupt change in color because they may feel embarrassed in public after having made such an abrupt change to the color of their hair. Moreover, the method and compositions of the present invention can be used in the shower, and on a daily basis, because the compositions and methods of the present invention, by contrast with current color compositions, do not employ

poisonous levels of chemicals and also because compositions methods of the present invention usually involve hair application steps that are up to about two minutes in length. By contrast conventional hair coloring compositions require approximately 30 minutes' time for each application, an amount of time, which is clearly not suitable for use in the shower.

The methods of the present invention are not as messy as conventional permanent hair coloring methods. The methods of the present invention do not use chemical compositions that are as smelly and noxious as those used in conventional permanent hair-coloring methods. Because the methods of the invention can be carried out in the shower, they do not involve the dripping and the mess associated with conventional permanent hair coloring. The methods of the present invention do not use chemical compositions that can stain fixtures in the bathroom or that will stain the scalp and the face. Compositions A and B upon mixture form a composition with a pleasing viscosity and that is pleasing to the fingers. This is because one or both of compositions A and B contain a cationic conditioning agent.

A dual package which can be employed in the products and kits of the present invention is disclosed in U. S. Patent No. 6,082,588 to Markey et al which is hereby incorporated by reference.

#### KIT CONTAINING AN INSTRUCTION SHEET

The invention also relates to a kit for carrying out the hair coloring method of the invention. The kit comprises an oxidizing or developer solution, an oxidation hair dye solution and a post treatment solution, each in a separate container or in a dual container, as described herein. The kit also contains written instructions that explain how the compositions of the invention are used.

The consumer admixes the components of the kit according to written instructions, to obtain the aqueous reaction mixture. The admixture may be carried out in a separate vessel external to the kit, or may take place in a container of the kit adapted to provide sufficient head space for mixing. The components that are mixed are the oxidizer or developer composition; and the oxidation hair dye composition. The reactants may also be admixed on the hair of the user. Essentially upon mixing, reaction of the dye and the developer will commence. After treatment for a desired time the mixture of hair developer and hair dye is removed, preferably with water or a conventional shampoo or a conventional conditioning shampoo.

As noted above, oxidation hair dye intermediate composition and oxidizing or developer composition are mixed together, and the resulting mixture can be applied to the hair and allowed to remain for a set time, usually about 1 to about 2 minutes.

The amount of desired change in hair color by the methods of the present invention is described by the mathematical formula above. Desired change in hair color can be measured in a number of ways. In the first instance, the consumer can compare his or her hair color with desired hair color or the hair color of a sample tress. Hair dyeing by the method of the invention can be repeated until his or her hair color matches the desired hair color. It is noted that the compositions used in the methods of the invention have lower contact times and thus repeated use of these compositions will not cause hair damage. An unexpected discovery of the present invention is that for damage to hair to occur, contact time in each treatment must go above the threshold value of about two minutes. Thus, the consumer can lighten or color the hair through repeated applications wherein the duration of each color application is about two minutes or less. The following two advantages are thereby achieved: first, there is a stepwise approach to the desired color; and second, a minimum of hair damage is done.

By the method of the invention, permanent or durable desired hair color, with longer lasting hair condition, clean soft feel, and a minimum of hair damage is achieved.



The consumer can also compare the color of his or her hair with the desired hair color, which can be printed on the package of the product. The consumer can also vary the number of days of application of the product, and the consumer can also vary the amount of time the mixture of part A and part B is left in the hair on each application. The number of applications can vary from about 7 to about 30 applications. The time of each application can vary from about 1 to about two minutes.

Desired hair color can also be reached by comparing hair after each treatment until it matches hair tresses taken from the consumer during a prior treatment.

Desired hair color can also be reached by testing the hair after each treatment with instruments, which measure the color of the hair. When the measurements of hair color of the treated hair reach a desired level, the treatment hair reach a desired level, the treatment can be stopped.

Indeed, reaching the desired hair color can be achieved by the use of any matching or comparison method commonly employed in the art.

The method of the invention occurs over a course of days. Therefore, the final color of the consumer's hair may be affected by the amount of exposure to the sun of the hair during the course of treatment.

Obviously, many modifications may be made without departing from the basic spirit of the present invention. Accordingly, it will be appreciated by those skilled in the art that within the scope of the appended claims, the invention may be practiced other than has been specifically described herein.